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OUR AMPHIBIOUS PERSICARIAS.

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There seems to be a rather widespread opinion among plant students and even botanists of note that *Persicaria amphibia* Linn., the Water Persicaria, is an aquatic plant, and *Persicaria Hartwrightii* A. Gray, is a terrestrial variety of it brought about by the fact that the aquatic plant was somehow made to take up a terrestrial or xerophytic habit. This idea seems to have gained strong hold particularly since the new Gray's Manual of Fernald and Robinson entirely suppressed the latter species reducing it to the rank of a mere variety. No one since the publication of the species by Dr. Gray seriously questioned its right to specific standing. Even when this rank was recognized the former was invariably described or illustrated as an aquatic and the latter as a land plant, because *P. Hartwrightii* was only known as a rough pubescent terrestrial and because *P. amphibia* was by American writers at least, not described or illustrated as any thing, but a water-plant. Most of the information for students regarding it was gleaned from manuals. Britton and Brown's Illustrated Flora of N. America, and Small's Monograph of N. Am. Species of *Polygonum* show only aquatic phases of *P. amphibia* and all the manuals describe it as a submerged water plant with floating smooth leaves, and a rose to purple short spike of flowers. Though the specimens of the European plant that have come under my observation are not many, *P. amphibia* of the old world, I have nearly always seen in herbaria as a rough leaved terrestrial plant without the least indication of aquatic habit. It would seem strange then that this rough leaved plant hardly appears to be mentioned in the manuals during the

* January 15, 1911.—Pages 1 to 28.

last two decades. The earlier manuals mention several varieties of *P. amphibium*, but since the publication of *P. Hartwrightii* the idea began to spread that all the dry land plants were to be referred to the latter and the aquatic to the former.

Some botanists have tried of late to persuade me—referring to the Symposium* at the fourteenth annual meeting of several botanical societies of America, and also calling my attention to the excellent and thorough work of Massart† on the accommodation of *Polygonum amphibium* to various habits—that *P. amphibium* had been changed into *P. Hartwrightii* and back again. The first idea that struck me on receiving this wonderful information was: "Why then is *P. Hartwrightii* even retained as a variety of the other?" Plants that change into different forms no matter how different, can hardly be considered even as varieties of one another. It would be absurd, for instance, to consider a caterpillar as a variety of butterfly once it has been shown that one evolved from the other. If some one had shown that *P. amphibia* became *P. Hartwrightii*, the logical thing to do would have been to suppress one of the names and relegate it altogether to synonymy, just as the scientists of old ceased considering caterpillars as species of worms when it was shown that they were only stages or phases in the development of butterflies.

The proposition was put to me that *P. Hartwrightii* was suppressed as a distinct species because Massart had shown that *P. Hartwrightii* had been converted by actual experiment into *P. amphibia* and back again, by growing these plants in aquatic and terrestrial or xerophytic conditions. Here certainly there seemed to be ample provocation to take a sarcastic fling at taxonomists, especially those suspected of wanton species making, but the species *P. Hartwrightii* by a strange fate was of the making of one of the most conservative of all our American botanists!

Not long ago there appeared a criticism of a botanist who presumed to publish a new species exhibiting certain differences from a previously known one, such as variation in intranodal separation and pubescence. It was found the difference was but a change in

* Report of the Symposium at the Fourteenth Annual Meeting, Chicago, Jan. 1, 1908. Cowles, H. C., An Ecological Aspect of the Conception of Species. Baltimore, Md., 1908, 266, 276.

† Massart, J. C. L'Accommodation Individuelle Chez *Polygonum amphibium* Bull. Jard. Bot. Vol. I. Fasc. 2, 1902.

passing from the spring to the fall plant of one individual; or that the plants which "in spring and early summer were *Helianthus illinoensis* were at the time of blooming and fruiting simply *Helianthus occidentalis*." Instead of suppressing the former the investigator "proposes that these plants should bear the name *Helianthus occidentalis illinoensis* Comb. nov." Strange as this may seem, the author of the *Helianthus* "subspecies" has made a proposition not a jot more absurd than the suppression of *P. Hartwrightii* from specific to varietal standing if it was done because Massart had shown that it changed into *P. amphibia* according to habitat in which it was found. Such was not the reason for relegation of *P. Hartwrightii* as a variety of *P. amphibia* though some symposium members seem to think so. This is evident from the manual itself as the terrestrial form, *Polygonum amphibium* var. *terrestre* is also mentioned, which may be taken, perhaps, for the phase spoken of by Massart. It would seem, however, that in view of Massart's discovery the use of the term "var. *terrestre*" would be eminently objectionable, for one might as well say that the caterpillar is a variety of butterfly, a method of phraseology which I doubt the authors of the Manual would tolerate or subscribe to.

I have in my personal investigations in the field found that the plant which the editors of the new Gray's Manual designate as *P. amphibia* with its varieties *terrestre* and *Hartwrightii*, has been known to have all the three kinds falling under the description of that book, on one and the same individual. In other words, by uprooting the rhizome near the water's edge I found branches coming from it and taking to the water, appear as shiny glabrous floating aquatic phase. The shore branches were upright and rough pubescent, and the shoots coming out in the grass farther up the bank had at least earlier in the season spreading herbaceous tips to the ochreae which according to the manual are characteristic of the variety *Hartwrightii*. Three "varieties" on one individual rootstock! And yet not one of these phases or forms of the same individual were either *P. amphibium* Linn., or the *P. Hartwrightii* A. Gray, but as I shall indicate later three distinct phases of *Periscaria mesochora* Greene!

On hearing of the assertion that *P. amphibia* had been converted into *P. Hartwrightii* I made it a point carefully to study Massart's work, and I was not a little surprised on first reading

it that it contained no mention whatever of the latter species nor of any other varieties whatever. In fact almost at the very opening of his article he says: "Le *Polygonum amphibium* ne varie guère; il ne presente, a ma connaissance, ni variétés, ni races." In spite of this I found it asserted without the least hesitation in the Symposium that "*P. hartwrightii*† can be developed at will by growing *P. amphibium* on land instead of in water." Dr. Cowles‡ does not tell us what warrant he has for such a statement, whether the result of investigations of his own not as yet published, or that the statement was made on the strength of another investigators' conclusions. Massart's researches were made on the European plant *P. amphibia* and as Dr. E. L. Greene* has shown this is a distinctively Old-world plant, not found in America, and that our plants have in all their phases characteristic, and distinctive marks by which they may readily be distinguished from the *P. amphibia* of Europe. As far as the ecological import of Massart's work on *P. amphibia* is concerned most of his results were known over 200 hundred years ago, and when these are made to be the principal part of his paper, one overlooks entirely the anatomical researches which are really the characteristic part of the article; for every thing in it centres around them for its originality. It would, to say the least, be very unsafe to draw conclusions about our American plants before it has been definitely ascertained that they are specifically identical with the old world *Persicaria amphibia*.

Dr. Gray can hardly be accused of being a reckless species maker, and such an implication need hardly have come from the editors of the New Manual, which would certainly seem to be the case in regard to the suppression of *P. Hartwrightii* therein. They

† *P. Hartwrightii* would be more correct.

‡ "One of the noblest aims of ecology is the destruction of many of the "species" of our manuals. Where the critical study of species is confined to the herbarium it often happens that ecological varieties or habitat forms are given specific rank. An excellent instance of this is seen in the case of *Polygonum amphibium* and *P. hartwrightii*. The latter, which looks wonderfully different from the former in herbaria, can be developed at will by growing *P. amphibium* on land instead of in water. Not infrequently a plant may be found on the edge of a pond, showing branches that would be regarded as *P. hartwrightii*. Symposium 1. c. p. 266. H. C. Cowles "An Ecological Aspect of the Conception of Species."

* E. L. Greene. Leaflets of Botanical Observations and Criticism. Vol. 1. 1904. pp. 24, 25.

meant to imply that Dr. Gray failed to see that *P. amphibia* though it has its terrestrial phase never has spreading herbaceous tips to the ochreae, has different pubescence and different inflorescence, even compared to the land phase of the American *P. Hartwrightii* which latter, as a matter of fact, has not till lately been reported in its aquatic phase. A careful study of the various phases of the Persicarias described by Dr. Greene in his classical researches on that most difficult group of plants—all the more so since so little, and often such poor specimens of plants have until lately been collected in that group with little or no data,—will reveal the fact that the plants discovered by him differ from one another greatly in their respective phases. In other words the European *P. amphibia* differs from the American *P. Hartwrightii* in its two phases, aquatic and terrestrial, compared with one another in each phase. *P. amphibia* has, moreover, been shown to have a third or xerophytic stage first pointed out by Massart. *P. fluitans* Eaton is not yet known in its terrestrial stage, which may not be present, but its aquatic form resembles in no way that of either *P. Hartwrightii* or *P. mesochora*. The latter known only heretofore in the aquatic phase, I have found in terrestrial and riparian forms in the lakes near the University.

P. coccinea Muhl. has its several phases more closely related usually, and often succeeding one another in the vicissitudes consequent on drying up of pools later in the season, but these forms differ widely from the respective phases of the other species mentioned. When Dr. Gray, therefore, published *Polygonum Hartwrightii* we may expect that as an experienced phytologist, and not at all a reckless one, that he must have seen that without the aquatic form even it was not to be confounded with the terrestrial form of *P. amphibium*. As to the validity of *Polygonum fluitans* Eat. the author of the name spent several years studying the plant in its native habitat, his description is unmistakable, and he distinguishes it perfectly from *P. amphibium* described on the same page, and yet to make an easy exit out of a difficult taxonomic problem the modern manual makers have been invariably content to jumble together a number of plants totally different by constant and definite characters, and excuse ignorance of them under the often used phrase “a very variable species.” When, however, the student of ecology is tempted to sit in judgment on the taxonomists for wantonly and recklessly multiplying names of plants,

let him remember that up until a few years ago the taxonomist had to do and actually did the ecologist's work besides his own of determination and classification. I dare say he was well prepared for his work being doubly trained to it by necessity as an observer in the field, and an exact student keen and quick to see distinctions which are noticed only after long experience.

I had for a long time entertained the suspicion that Linnaeus was not the first to have noticed that the European Water Smartweed, lived on land and in water in different phases. I had spent some time even before becoming at all generally interested in the members of this group of plants, in tracing back the history of *P. amphibia*, a matter not as easy to a beginner as it might at first seem; for the names given by some pre-Linnaean writers were not the same as ours. A clue to the possible origin of the Linnaean trivial name *P. amphibium* was found when coming by chance upon a reference to the plant in Gilibert's History of Plants of 1806.* *The Flora Suecica* 1745 of Linnaeus contains the description of a possible clue to the origin of the name itself, whereas J. Ray's History of Plants quoted by Gilibert describes the ecological facts that probably led to the giving of the name. I shall quote as much of the passages in the original as are necessary to make the statements clear.

"909 La Persicaire amphibie, *Polygonum amphibium* L. A fleur à cinq étamines; à style fendu en deux; à épi ovale; à feuilles ovales, lancéolées, ciliées. Dans les lieux aquatiques, au Broteaux, à Oullins, et dans les terrains secs, à la Carette. Fleurit en Août.

Persicaria Salicis folio, *Potamogeton angustifolium dictum*. Rai. hist. 184. *Persicaria Salicis folio*, *perennis*. Hort. Lugdun. Batav. Dod. pempt. 482, fig. 1. Lob. icon. 307, fig. 2. Hist. Lugd. 1008, fig. 1.

Rai a fort bien remarqué que cette plante n'étoit qu'une variété du *Potamogeton Salicis folio*, C. Bauhin. Pin., qui se trouvant hors de l'eau, change de forme, et en impose aux plus habiles Botanistes; mais il est aisé de voir que ce n'est qu'un déguisement de la même plante, parsqu'on trouve souvent sur le même pied des feuilles lisses et luisantes, et d'autres qui sont semblable a celles du Saule, mais plus longues, rudes, et velues: il faut rapporter

* Gilibert, J. E. Histoire des Plantes D'Europe et Etrangers, Ou Elemens de Botanique Pratique, 2nd. Edition, 1806. p. Vol. I., p. 453.

a cette espece la *Persicaria major*, *foliis hirsutis*, *gustu acerbis*, *floribus albis aut purpureis*, Lobel. observat. 17, et la *Persicaria major*, *caule sesquicubitali*, *striato*, *tereti geniculato*, *Thalii*. Tournefort.

Observat. La racine très-longue, de quarte pieds, trace dans la vase, jetant de ses noeuds des radicules; les feuilles lisses, cori-acées, a nervures parallèles, transversales, ciliées ou dentelées sur les marges; l'épi des fleurs épais; le calice rose, ovale, campanulé les anthères posées transversalement sur le filament sont de couleur de chair; telle est l'aquatique; la terrestre à feuilles plus larges, plus dures; à fleurs d'un rouge-foncé."

Gilbert's observations are not claimed by him as original, and he refers to Ray when he describes the two different phases, aquatic and terrestrial, which he says are often found on the same rootstock. Gilbert does not, moreover, describe the phases as even different varieties, which of course, we could not expect him to do in view of the identity of the plants phases "found even on the same rootstock or base." He also seems to approach the method of describing these phases separately though not in separate paragraphs, a system Dr. E. L. Greene has so often insisted on, and a system which alone can give a true idea of all plants that exist in two or several entirely distinct phases, a method too, not appealing favorably to the authors who must be guided by the bibliopole aspect of the species question.*

It is hard to convince manual makers that when phases exist in various stages it should be desirable to describe each in a separate paragraph in order to bring out differences in such a way that the student may recognize them in whatever form or stage he finds them. Besides the Persicarias, other plants seem to show a very different appearance at various stages of development. Probably one reason why the violets are considered a difficult group of plants for the beginner, is that he finds them often in a stage of growth in which the foliage and other characters are not the same as the manual maker found them. Violets might well be described, as the amphibious persicarias should, in separate paragraphs for their different phases. Few there are that have not noted the difference between the characters of these plants in the stage when they bear petaliferous flowers, in contrast to that in which the second or cleistogamous flowers appear.

* Am. Mid. Nat. Vol I., 248, Aug. 1910.

The following is found in John Ray's History of Plants,† which, as far as I am able to find, is the earliest reference to the fact that *P. amphibia* existed in totally different forms as the same identical plant. I shall quote the whole paragraph in full:

"A. 6. *Persicaria Salicis folio*.

Potamogiton angustifolium dicta.

Potamogiton angustifolium Ger. 2, sive *Salicis folio* C. B.
Potamogiton sive Fontalis Persicariae foliis J. B. *Fontalis minor longifolia* Park,

Narrow-leaved Pondweed or Arsmart.

Folia huic Persicariae maculosae foliis similia sed majora, venis obliquis et transversis in marginem a nervo, qui unicus secundum longitudinem dirimit exporrectis; alioquin etiam non ita sunt obtusa sed in acumen desinentia, et pro loci situ [extra aquas] nonnunquam hirsuta, aquis plurimum innatantia, pediculo sescunciali aut sextantali ex caulium geniculis orto inter quae palmo saepe brevior pediculus exit, in spicam congestos flosculos Persicariae gerens ex albo rubentes. Gustu est subacido.

In paludibus, lacubus, stagnis necnon in rivulis et aquis fluentibus ubique frequens reperitur. Cum extra aquas crescit (quod non raro fit vel aquis exsiccatis eam deferentibus, vel ipsius radicibus in fossarum aggeres ejectis) folia obtinet hirsuta, aspera et Persicariae in modum maculosa, unde tunc a nonnullis pro nova Persicariae specie, a Potamogitone angustifolio diversa habita est. Quin in eadem individua (ut loqui amant) planta folia nunnulla nimirum extra aquas nascentia, observavimus aspera et hirsuta, alis, aquis scilicet innatantia, laevia et lucida.

Haec ergo planta Persicaria acida peculiaris *Cat Altdorf* nobis videtur, Persicaria hirsuta radice perenni *Cat Lugd. Bat.* Persicaria longissimis et angustis foliis seu fol. Salicinis *D. Merret* quam pro specie a Potamogitone angustifolio distincta per errorem habuerunt, quamvis recte eam Persicariis annumerarunt. Nos etiam (nec pudet fateri) in eodem errore aliquamdiu haerimus nimirum hanc Persicariae speciem fuisse a Potamogitone angustifolio dicto diversam."

I believe that it will be admitted by all that as an ecological study of *P. amphibia* together with a right interpretation of the facts, the above mentioned work of Ray is as clever an investigation

† Ray, J. Hist. Vol. I, p. 185 (1686.)

as would be done in our own time with all our modern advantages. It will seem the more marvellous when we consider it to have been worked out correctly about two centuries and a quarter ago. It looks too as if Massart had not added, from an ecological point of view, very much to the work of Ray except perhaps the finding of the xerophytic phase of the plant. It is being found gradually that not a few of the discoveries attributed to modern scientists are modestly recorded in the older herbals and writings of the botanists of hundreds of years ago. With the fashion growing that 1753 is the beginning of taxonomy it is also not infrequently come to be believed by some that plant physiology, ecology and anatomy go back no further.

The remarks of Ray need no comment of mine to make them more emphatic, except that had the present day student known as much of the ecology of *P. amphibia*, we might have been spared much misunderstanding about the plant. It is a sad commentary on modern ecology that we must yet learn over again the discoveries of centuries ago and admit that in forgetting, or not thinking it worth while to study old dusty tomes, we have to learn again by the hard method of renewed experience what we could find out in a few minutes consultation of the much derided herbalists of old.

Ray's statement that the smooth, floating aquatic plant known to the ancients and older writers as *Potamogeton*,* is positively the same as and identical with the plant called, up to his time, *Persicaria salicis folio*, the terrestrial, is worthy of note. He no longer sees the need of the former name and reduces it to synonymy. He says that botanists of his time had taken them for separate species, and warns future investigators not to do the same, noting that some had thought the hairy plant (his *Persicaria salicis folio*,) as a distinct species from the water plant, (*Potamogeton angustifolia*.) He admits that he himself had in error formerly thought these plants as different species though not ashamed as he is now to confess it, intimating too thereby how easy he might

* There is no doubt at present that *Potamogeton* of Dioscorides, Pliny of the ancients and of the herbalists of the 15th. and 16th centuries is no other plant than *P. amphibia*. See E. L. Greene. Leaflets, Vol. 1. p. 24, Bubani. P., Flora Pyrenaea Vol IV. p. 10. See also Dodonaeus, R. Pempt. p. 572. (1583) also Kruid Boeck. (1644) p. 623. Lobelius, M. Observ. p. 164. (1576.) Chabraeus D. Stirp. Sciag. p. 563 (1677). See also Morison Dalechamps, Tabernaemontanus. etc, etc.

have found out the simple facts had he sooner taken up the study of their habitat. He claims that he had found these two phases of the plant—though he does not call them such,—on the same rootstock,—“in eadem individua.” In every respect does he give the habitat of the two stages of the plant even describing the circumstances that lead to the change of the aquatic to terrestrial that is, by drying up of the pools, not a rare circumstance, and the casting up of the roots from ditches, and that then the leaves become “hirsute rough and spotted like a *Persicaria**.” He says even that certain authorities whom he quotes, though they consider these phases as different plants, yet they thought them both *Persicarias*.

That Linnaeus himself knew of the amphibious nature of the European plant is evident from the following taken from the *Flora Suecica* of 1745.†

“318. *PERSICARIA floribus petandris digynis corolla staminibus brevior.*

Persicaria florum staminibus quinis corollam superantibus, stylo bifido. Hort. Cliff. 216. *Persicaria major amphibia, radice perenni.* Pluk. alm. 288.

Potamogeton salicis folio Bauh. pin. 193.

β *Persicaria palustris fluitans, foliis brevioribus et latioribus florum spica purpurea compactiore.* Rupp. jen. 72.

Habitat α *ubique erecta in pratis argillosis juxta vias et agros at β fluitans in fossis et paludibus; singulari varietate.*”

It is evident from the above that Linnaeus referred to the floating plant which he calls variety β of Ruppert as a mere variation of the rough terrestrial form, α. It is also evident where he gets his trivial name *P. amphibia* of the *Species Plantarum* of 1753. It is borrowed from Plukenet's description quoted above. Another fact worthy of notice is that in the *Species Plantarum* of 1753 and subsequent editions he no longer considered the floating form as even a variety, but in view of the fact that Ray had found that one changed spontaneously into the other according to habitat, Linnaeus suppressed entirely the varietal standing of the phases well

* Reference probably is made to *Persicaria maculosa* or *Polygonum Persicaria* Linn.

† Linnaeus, C. *Flora Suecica*, 1745, p. 115.

aware that no matter how different two stages of one plant could be, as long as their absolute identity was shown they can no longer be considered as even varieties of one another in the strict sense. This fact, self evident as it may appear, in view of the above discussion does not for some reason or other or because of want of knowledge of the identity of the phases seem to have been apparent even to our American manual makers, or if known is deliberately concealed or superficially passed over.

A still more interesting passage may be quoted from the *Hortus Cliffortianus* of Linnaeus, (1737), pp 41, 42.

"1. PERSICARIA florum staminibus quinis, corollam superantibus stylo bifido.
stylo bifido.

Persicaria major amphibia radice perenni. Pluk. Alm. 288.

Persicaria, salicis folia, Potamogeton angustifolium dicta Raj. hist. 184.

Potamogeton salicis folio. Bauh. pin. 193.

α. Persicaria, salicis folio perennis. Herm. Lugd. 488.

β. Persicaria palustris fluitans, foliis brevioribus et latioribus, florum spica speciosa purpurea compactiore. Rupp. jen. 78.

Crescit haec planta vulgaris per Europam in humidis praesertim.

Variat si qua alia, maxime manifeste utpote quae (α) in argillosis agris caule gaudet erecto, foliis lanceolatis acutis scabris & hispidis communiterque sterilis persistit; at (β) in aquis caule flaccido foliis ovato-obliquis, obtusis, glabris & nitidis, spicamque florum subovatum et crassam gerit: unam tamen eandemque plantam esse cum Rajo, et recentioribus agnoscunt etiam varietatem aestimatores; unde non illepide a Plukenetio amphibia dicta fuit."*

From this reference it is perfectly evident that Linnaeus was early acquainted with Ray's researches on the ecology of the plant and also that, as I have already intimated, he picked the name *amphibia* from Plukenet's short diagnosis or name. Though in the *Hortus Cliffortianus* and the first edition of the *Genera Plantarum* (1737) Linnaeus admitted the natural genus *Persicaria* he afterwards suppressed it in the *Genera Plantarum* of 1754 and the name does not appear with any of the species in 1753.

Haller† also insists on emphasizing the fact that the plant

* Misprint for *amphibia* without doubt.

† Haller, A. Hist. Stirp. Index. Helvet. Vol. II. (1768) p. 261.

exists in two forms which he describes in separate paragraphs headed as follows:

"1856. *POLYGONUM foliis ovato-lanceolatis, ciliatis, spicis ovatis.*

α . *Planta foliis aquae innatantibus.* (Various references are here given.)

β . *Planta terrestris, caule recto, foliis manifeste hirsutis."*
(References to older authors.)

Then follow two separate paragraphs on the aquatic phase and then one on the description of the terrestrial phase.

The last paragraph refers to such general characters as taste and pharmaceutical properties.

In view of the classical work of Dr. E. L. Greene in distinguishing the various phases of many of our American amphibious *Persicarias*, and also first describing these phases in separate paragraphs,—a new modern taxonomic feature for plants, and the only logical method of treatment,—it would seem that any statement of facts that I have here made were but tautological repetition. Certain prejudices, and especially taxonomic ones, are, however, with difficulty removed, and it often takes more than one emphatic repetition to establish what is looked on as but an unfriendly comment on popular misbelief. Dr. Greene's treatment of the *Persicarias* was published in limited edition, for the masters of botanical science rather than for its students, and the fact of the matter is that few have taken the trouble to have access to his work, and many have doubtless preferred to pass it by with a prejudiced attitude of mind.

Regarding the European specimens of amphibious *Persicarias* not at all common or numerous in our American herbaria, I have usually found that the terrestrial phase is oftener found. It may be,—and I may say it here in passing—that one of the reasons we on our side of the Atlantic know often less of the distinctive characters of American plants, is that we have neglected to study properly the plants of Europe, and our herbaria in general are sadly devoid of such. This fact is all the more to be lamented that we must know that the types of cosmopolitan plants are of course generally the European specimens, and so it not infrequently happens that new American plants are published not by our botanists but by old world students who, perfectly acquainted

with their own specimens are quick to see that they differ from ours.

If we consider that Dr. Gray may as likely as not have seen the terrestrial phase of the old world *P. amphibia*, we can see that in comparing it with *P. Hartwrightii* he must have found sufficient reasons for considering it a new species, even if he only saw the terrestrial stage of the latter. Its aquatic phase was, as far as I have been able to find, not known until discovered by Mr. L. Andrews in New England. As the Old world plant according to Dr. Greene has its separate and distinctly different aquatic as well as terrestrial phases we want something more than a mere jumping at unwarranted conclusions on the part of some American botanists before we can be blamed for not believing that *P. Hartwrightii* can be developed at will from *P. amphibia* by changing its habitat, or before we can feel that the most conservative Dr. Gray should have published *P. Hartwrightii* as a new species with insufficient reasons.

Having spent so much of this discussion of the American botanists' view of these plants,—a more or less theoretical aspect—I shall now pass to the study of the plants themselves as distributed in our locality. In enumerating the plants I shall include first the synonymy of the European *P. amphibia*, even though it is not found in our country. I shall trace particularly its pre-Linnaean history, aware of the fact that it is not as difficult a matter to give its synonymy since 1753.

As far as I am able to find no one has as yet suggested putting the amphibious Persicarias in a separate genus. They certainly seem distinctive enough to deserve being gathered together as a special group in the genus Persicaria.

Rafinesque had suggested the genus (or subgenus) *Chulusium* for those species 'with unequal calyx, five stamens, two stigmas and a lenticular seed.' He mentions this in reference to *P. punctatum* (?) and as the characters are either inconstant or not applicable to the amphibious solely and distinctively, I doubt whether the name could rightly be applied them. Though no type is mentioned *P. punctatum* would be considered such were the name ever taken up for so peculiar a group, because that is the species under which the publication of *Chulusium* is made. Moreover, it does not seem clear just what *P. punctatum* Raf. really is, and this makes the publication of the genus even a matter of some uncertainty.

I suggest as a section of the amphibious smartweeds under the genus *Persicaria*, the name POTAMOCALLIS.

Genus PERSICARIA Tragus, 1531 in Brunfel's Herb. Viv. Icones. Brunfels. App. p. 18. (1531) also Tragus do. p. 161. (1531), also *Pulicaria* Brunfels 1531.

Persicaria Trew in Herb. Black (1754) Tab. 118 and 119.

Section POTAMOCALLIS.

PERSICARIA AMPHIBIA (Linn.) S. F. Gray, (1821) Nat. Arr.

Br. Pl. Vol. II., 208.

Potamogeton Dioscorides Ex Comment. Ruellii (1547).

(See also references on p. 9)

Potamogeton angustifolium Gerard. 821. 2 also *Tabernaemontanus* l. c.

Phyllitis lacustis Cordus, V. Hist. (1561).

Potamogeton ἰτερόφυλλον Thalius, Sylva Hyrc. (1588.)

Potamogeton 2. Dalechamps. also Caesalpinus. De Plantis p. 332.

Potamogeton Salicis folio Bauhin, C. Pinax, 193, (1623)

Persicaria salicis folio, *Potamogeton angustifolium dicta* Ray J. Hist. p. 184.

Persicaria major amphibia, *radice perenni* Plukenett, L. Alm. 288.

Persicaria Salicis folio perennis Hermann P. (1687) p. 488.

Persicaria floribus pentandris digynis, *corolla staminibus brevior* Linn. Fl. Suec. p. 115.

Persicaria florum staminibus quinis corollam superantibus, *stylo befido*. Linn. Hist. Cliff. p. 41.

Fontalis major longifolia Parkinson J., Theat. 1254 1a.

Potamogeton angustifoliam seu Salicis folio, *nobis etc.* Morison, R. Plant. Hist. Univ. Vol. II. p. 587. (1715).

Polygonum amphibium Linn., 1753. Sp. Pl. p. 361, not of American authors.

Flowering specimens in the terrestrial phase No. 2823 of the University Herbarium gathered in 1856 in England (Miss A. Smith) Seashore....(?)....Aug. 1856. A specimen which I studied in Dr. Greene's herbarium is also in the terrestrial phase.

PERSICARIA HARTWRIGHTII (A. Gray) Greene, (1904.) Leaflets
Vol. I. p. 24.

Polygonum Hartwrightii A. Gray, (1870) Am. Acad. VIII. p. 294.

Including *Persicaria abscissa* Greene, (1905.) Leaflets,
Vol. I. p. 108.

Terrestrial Phase. Plant low, densely leafy, roughish pubescent or almost glabrous, from a creeping underground rootstock, internodes short less than 2.5 cm. and naked one third their length, the rest invested with an appressed bristly hairy ochrea, the limb of which is bristly ciliate, or sometimes without limb or border: leaves oblong to oblong-lanceolate 8.5-12.5 cm. long, acutish at both ends, glabrous above to sparsely strigose, the upper surface near the margin with a few hair points or often strongly but appressed hairy: margin appressed spinulose: lower surface glabrous or with a few scattered spinulose hairs along the midvein, lower veins and veinlets often muricate scabrous or the murications each with a long hair: peduncle of the oval spike more or less hirtellous; bracts strigose or hirtellous.

Aquatic Phase not known as yet from our region.

Specimens slightly more hairy than the type were collected by me in terrestrial phase at Bankson Lake, Michigan. No. 593951 of the U. S. National Herbarium collected by O. A. Farwell, Sept. 3, 1892, agrees better with the type except as to slight difference in pubescence of the peduncle.

No. 593948 also of the U. S. National Herbarium and collected by the same, at Belle Isle, Mich., Aug. 1904, may also be referred here.

Aquatic Phase. Leaves glabrous shiny floating, with long slender petioles: leafblades tapering to the petiole, not subcordate or cordate as in aquatic state of other Persicarias. (See Greene, E. L. Leaflets. Vol. I., p. 109.)

Hairy sterile specimens found by me in low fields and marshy places may possibly be referred to *P. Hartwrightii*. Such plants are invariably sterile, and even appear in cultivated fields, or along ditches growing from sand or mud recently cast up. I have collected such at Benton Harbor, Mich., Mishawaka, Ind., near and at Webster's Crossing in a marsh north of Notre Dame.

PERSICARIA FLUITANS (Eaton) Greene, (1904) Leaflets, Vol. I.
p. 26.

Polygonum fluitans Eaton, (1840.) in Eaton and Wright N. Am.
Botany, p. 368.

Polygonum amphibium of the American authors either in part or by mistake, not of Linnaeus.

Aquatic Phase. Stems very slender, submerged internodes 8–15 cm. long, the floating ones 2.5–3 cm. Leafblades perfectly glabrous and slimy when young, elliptical to elliptic-oblong usually dark red on the lower surface, 3–12 cm. long hardly ever even subcordate at the base, but tapering abruptly at both ends: spike solitary, short cylindrical, slender peduncled; bracts, broad ovate, acute, glabrous: peduncle purple smooth.

Riparian and Terrestrial phases not known. Found floating mostly far away from the shore of sandy bottomed or sometimes muddy lakes, usually so far from the shore that any attempt to connect it with a land phase seemed hopeless. Though hairy and sterile forms with a spreading rim to the ochrea were found in the sand some yards from the water line, no connection between them could be shown. It was not infrequently found over 100 or even 130 feet from the water's edge. Collected at Bankson Lake, San José Park, near Lawton, Mich. by myself. It is No. 262 of my herbarium. The plant differs from the European *P. amphibium* in that the latter has lanceolate and subcordate leaves with sharply scabrous margins.

The plants were growing with *P. grandifolia* but usually farther out and in a depth of several metres of water.

PERSICARIA MESOCHORA Greene (1904) Leaflets, Vol. I., p. 28.*

Polygonum amphibium of American authors in part. Not of Linnaeus.

Aquatic Phase. Plant larger and stouter than *P. fluitans*: petioles as long, but not as slender: leafblades different in shape and color, light green with but a slight indication of purple brown or red, commonly 12 cm. long, and 3–5 cm. broad, ovate to elliptic lanceolate according as the base is broad or subcordate or rounded, or somewhat tapering, glabrous and slimy when young sometimes minutely puncticulate: spike solitary, rather long stalked, cylindric 2.5–3.5 c. long: peduncle dark purple glabrous: bracts ovate acute glabrous usually partly colored like the flowers.

Riparian Phase. Stems stouter: internodes 7.5–10 cm. long and somewhat fistulous, especially lower down: leafblades

* This plant is probably the one most commonly taken for *P. amphibium* in our region.

broadly lanceolate, very acute, rounded, truncate or subcordate at the base; petioles 7.5–10 cm. long, those of the uppermost showing slight traces of hairs in form of a diminutive muriculation: spikes often 2, cylindric, longer and narrower than that of the aquatic phase. Leaves with a slight gloss of purple beneath particularly noticeable when fresh leaves are viewed at angle; ochreae close-appressed, glabrous, shiny: young leaves slimy in the water, the slime drying to a thin silvery film on recession of the water: margin of the leaves often minutely and appressed scabrous ciliate.

Transition Phase. (a) Offshoots from the rootstock at the very edge of the water often become prostrate and as they lengthen out by growth, become floating riparian or aquatic phases: the leaves at first more or less roughish pubescent "slime off" their hairiness, the newer leaves often being almost smooth: shape of the leaves passing gradually into those of the aquatic from the terrestrial. (b).

(b.) Erect stems at the water's edge or in a few inches of water arising from a subterranean rootstock: leaves in shape nearly like those of the terrestrial form much narrower than those of the aquatic or riparian, about one half as wide, usually nearly as long, rather long acuminate to a bluntish apex, subcordate or obtuse: leaves bright green and when in flower usually glabrous except minutely scabrous on the veins and margin: the lower earlier leaves often scabrous on the upper surface near the margin: ochreae very thin, glabrous the lower ones often with some long scattered appressed hairs. Herbaceous spreading margin of ochrea never developed by any phase late in the season.

(c.) *Early Spring and Summer Transition Phase.* Plant more or less hirsute or hirtellous varying with the age of the shoot, the earlier plant with long scattered spreading hairs, especially on the midrib veins and the upper half of the ochrea, the latter usually appressed: ochrea with a more or less wide spreading green, hirsute ciliate herbaceous border in spring plants, absent in summer: spike slightly narrower than the aquatic; peduncle usually dark purple, scabrous, glandular in all transition forms: bracts of the flowers in all phases ovate glabrous, acute at the apex.

Terrestrial Phase. Plant more or less hirsute scabrous pubescent or even glabrous according to the season; never known to flower: ochrea with spreading tips seldom present or small at

least when the other phases are blooming: leaves in general as long but only about half or little more than half as broad as those of the aquatic phases, always rough margined and scabrous on the veins and midrib: varying as to ochrea border according to the season as above; pubescent as in the preceding. Early in the season the whole surface of the leaf, upper as well as lower, as also the ochrea are sparingly hirsute with long white hairs: general shape of the leaves lanceolate to oblong, but the base usually subcordate, apex long acuminate: petioles 5-8 mm. long: internodes about 2 cm. in length above and 3-6 cm. below where the older leaves have wilted: young leaves dark purple on the lower surface.

As far as I am able to learn this is the first report of discovery of the terrestrial phase and its varieties as connected with *P. mesochora*. Complete description of any one phase is quite difficult as plants may be found in which the lower leaves (developed in spring) are very hairy and the upper ones quite glabrous except on the margins and midrib. I have several times unearthed rootstocks having on one and the same plant all the different phases mentioned above, from the strictly aquatic or riparian forms to the most hairy terrestrial branches. Such specimens, owing to their length often 2 or 3 metres or more, are difficult to preserve. In spite of this wonderful variation of the different phases, *P. mesochora* is readily distinguished by constant characters of leaf shape, spike and ochrea from all the other aquatic or terrestrial forms of other amphibious Persicarias. Ochreae never have spreading borders in the blooming forms, thus distinguishing it easily from *P. Hartwrightii*, as well as in shape of leaves and flowering spike. On the other hand *P. fluitans* is readily distinguished in the aquatic phases by smaller foliage, leaf shape, and long wiry stems with slender leafstalks. The shape of the leaves of the European *P. amphibia* as well as the spike are totally different, apart from the fact that the old world plant never had spreading herbaceous borders in any of the stages of its various phases. Besides that, the leaves of *P. amphibia* are mucronulate at the apex.

Plants representing *P. mesochora* in my herbarium are Nos. 263a, 263b, 263c from St. Mary's Lake, also 267a, 267b, 267c from St. Joseph's Lake, Notre Dame, Ind., gathered in the summer of 1909. I have also found the plant in 1908 and 1909 in a deep ditch along the South Bend & Chicago Interurban Electric Line

near Hudson Lake. I was unable to collect specimens here. Farwell's No. 593946 of U. S. Nat. Herb. collected near Detroit may be referred to *P. mesochora*.

From both of the Notre Dame Lakes I have several times with considerable trouble obtained shoots having all the phases in one individual. The fact that the high shore or terrestrial phase never matures flowers seems to show that the plant is normally aquatic. I have observed specimens of the terrestrial on what must have been the old shore line of the drained and lowered lakes at Notre Dame in 1843. Some years after the lowering of the water these plants were left high and dry in the grass, 50 feet or more from the present shore. They appear annually and the rootstocks even seem to spread. Only once or twice within the last five or six years have I observed a spike of buds which wilted invariably before reaching the flowering stages. It is undoubtedly *P. mesochora* and the patch is only a short distance from another on an island of the lake formed in the last dredging a few years ago.

In another place near St. Mary's Lake the terrestrial plant is usually mowed down in summer. The young shoots appear with spreading borders to the ochreae, which are absent in older growing plants at this time. This too is undoubtedly *P. mesochora* as it is but two or three metres from the shore where riparian and aquatic phases flourish, and where I collected specimens with all phases on one individual. Moreover, no other *Persicaria* grows anywhere around either of the lakes. I have watched all these plants during several seasons from spring till fall and studied the different stages in the development and transition of the phases. As has been noted in the description of the phases, matters are complicated even more by the fact that the phases themselves, especially the terrestrial in case of *P. mesochora*, vary somewhat in appearance from one part of a season to another, so that the terrestrial phase looks quite different in summer and early fall from what it did in spring. Dr. Greene* has pointed out that our knowledge of the aquatic *Persicarias* will then of necessity progress slowly until botanists in their respective sections of the country begin to study carefully the variations of the plants under changing conditions throughout the year.

* Greene, E. L. Leaflets, p. 25, 26.

PERSICARIA COCCINEA (Muhl.) Greene, (1904) variety ASPRELLA.
Leaflets Vol. I., p. 24 & 36.

Polygonum coccineum Muhl., (1809.) in Willd. Enum. Hort.
Berol. p. 428.

Probably (?) *Polygonum amphibium* var *β. emersum* Rich.
in Michx. (1803) Flor. Bor. Am. I. 240.

Polygonum Mühlenbergii S. Wats. (1879) Proc. Am. Ac.
XIV. p. 295.

Polygonum emersum (Michx.,) Britton, (1889) Trans. N. Y., Acad.
Sc. VIII. p. 73.

Persicaria emersa (Michx.,) Small., (1903). Fl. S. E. U. S., p. 376

Terrestrial Phase. Plant upright from a creeping or underground rootstock about 6 dm. high, rather leafy, foliage petiolate ascending: blades ovate elliptic or elliptic lanceolate, 12-20 cm. long abruptly acuminate, both faces of the leaf rough with scattered short hairs or nearly glabrous, veins and veinlets rough with appressed bristly hairiness instead of muricate scabrous: bracts of the spike strigose on the back and ciliate with long hairs on the margin: spike 3-7.5 cm. long: peduncle purple with short spreading glandular hispidulous hairs: ochreae thin sparingly strigulose roughened with short sharp hairs.

Riparian stage of the variety not as yet found in our locality. I have found the plants in great abundance in low places where but a few inches of water stood in spring which was completely dried up in summer and fall. It does not seem to invade deep water in our region, and blooms normally in the terrestrial phase. I have collected it from a small pool in the middle of a cultivated field southeast of the University, also near the ice house east of the University, where its terrestrial sterile branches run high up on the sand and gravel embankment of the road. It is here found together with another amphibious *Persicaria* which for want of proper material collected in flower, I have not been able to determine but which may be a terrestrial form of *P. mesochora*, stranded when the marshy pool was cut off by the road from one of the lakes. I have also found the plant during the last season around Hudson Lake west of South Bend, Ind., abundantly in flower and fruit. Nos. 260 and 261 of my herbarium.

PERSICARIA GRANDIFOLIA Greene, (1904) Leaflets Vol. I., p. 37.

Terrestrial Phase. Stems $\frac{2}{3}$ -1 m. rather slender very leafy to

the summit: nodes abruptly swollen, internodes about 5 cm. long; leaves 12-20 cm. long with a petiole of 2-3 cm. included; blades cordate oblong, subcordate varying to obtuse and the upper even acutish at the base, vivid green, glabrous or beset with numerous short soft hairs (leaves not even roughish to the touch) hairs on the midvein scouter roughish, petioles rough scabrous.

This phase found usually around deep muddy ponds where the fertile aquatic phase grows. The plant becomes ranker in growth as it approaches to the water, and gradually merges into what may be called the strictly fertile aquatic phase. Plants on dry land never produce flowers, and sparingly so in mud. Terrestrial plants creeping in mud covered with several inches of water have been found with smaller spikes of rose to deep purple flowers.

Aquatic Phase. Internodes much longer, fistulous in the floating form often 2-3 metres long, rooting from the nodes, the branching roots floating like plumes in the water: leaves 10-25 cm. long and the larger 7 cm. broad cordate oblong; with blunt points on the basal lobes giving the larger leaves a subsagittate appearance; leaves glabrous, slimy, dark green, the margins somewhat scabrous-serrulate with hair points, acute at the apex: petiole 7-10 cm. long, spikes linear, 3-9 cm. long rich rose red, bracts hirtellous uncommonly long pointed cuspidately rather than acuminate: peduncles slender strigose glandular or hirtellous often one of the spikes glandular and the other at least partly.

The above description holds good only regarding the submerged and the flowering part of the aquatic phase. As the stems rise assurgently out of the water nearly a metre deep, and exposing the tops of the stems above the water to the height of 3-5 dm. the upper five or six leaves take on the character of the foliage of the terrestrial sterile phase regarding pubescence, shape etc. All the gradations of character may be found in passing from these more or less pubescent leaves to the larger, slimy, glossy, aquatic leaves below on the same shoot. The submerged leaves as the stem sinks, by the weight of the flowering top, soon turn yellow and decay.

The flowering phase thrives best in nearly a metre of water. Only the submerged stems are thickly fistulous often nearly 1.5-2 cm. thick and bright green. This peculiar habit of the aquatic in growing out of water with the leaf variation is characteristic.

It is easily distinguished from *P. coccinea* which blooms only in the terrestrial phase. The terrestrial phase growing in great abundance on the shore never produces flowers in *P. grandifolia*. The spike too is usually longer than that of any amphibious *Persicaria* known to me. I have found one spike nearly 10 cm. long! The peduncle is usually brownish hirtellous but often with short spreading purple rough glandular hairs.

I have found both phases of this plant in great abundance in a muddy pond near Bankson Lake, Mich. where it is associated with *P. fluitans*, but not growing so far from the shore as the latter. It is not found in Bankson Lake proper as *P. fluitans* is, as it does not seem to thrive in the sand where waves usually disturb the equilibrium of the emerged tops. The plant is more abundant among long high sedges and grasses which partially help in keeping it erect. I found it in open water only in such parts of the pond as were protected by a high hilly bank from the prevailing wind of the locality.

The plants were collected by me in both phases at the aforementioned place on July 13, 1909, and the specimens are No. 265a and 265b, of my herbarium.

I have compared all the plants described above with the types in Dr. Greene's herbarium in Washington, or those in the U. S. National Herbarium. What is considered as sufficiently typical *P. Hartwrightii* is in the U. S. Dept. of Agriculture Herbarium collected by Mr. S. Hart Wright himself at Penn Yan, N. Y. and with which I compared my specimens of that plant.

I can not pass by this enumeration and study of our local amphibious *Persicarias* without referring to a plant of the group whose aquatic and terrestrial forms I found near Portland, Oregon in Aug. 1908, and 1909, because the case may be illustrative of conditions found in certain localities of our region. The plants were collected in two places though in each case subject to the same habitat and conditions. One of these was found along the Willamette River near St. Johns, Ore., the other on the shore of a backwater or slough called Mox's Bottoms in front of Columbia University, near Portland, Oregon. During the last summer while doing some research in the U. S. National Museum, I compared the specimens carefully with Dr. Greene's type plants, and found them to be *Persicaria oregana* Greene. The plants are Nos. 264 and 266 of my herbarium.

The conditions under which these plants grew were exactly the same although in the first case the plant was found over one hundred yards from the river bank. The specimen from the bottoms grew on a rather high sandy and stony bank which rose precipitously a few metres beyond up to Willamette Boulevard to the height of over one hundred feet.

The other plant was found in the aquatic stage high on dry land at the considerable distance from shore mentioned. The stem devoid of any leaves except a few aquatic glabrous pale green ones at the end of the branches, were spread promiscuously over old water washed weathered logs, tin cans, and rocks. The stems were several metres long and all could be traced to a number of rootstocks in the sand. From the place where the aquatic phase grew there appeared also short hirsute shoots with rough green leaves, and broad spreading borders to their ochreae. These came from the same rootstock from which the long stringy aquatic shoots appeared, and yet were totally different in appearance. One of the shoots was distinct aquatic without the least trace of pubescence, the other sterile terrestrial shoots densely covered all over leaves, stem and ochrea with long spreading hairs. The plant in the other locality showed essentially the same characters. The aquatic phases only bore at the ends of the long branches a short spike of rose-colored flowers arising from the three or four leaves. Both plant groups were growing from a point several decimetres below the line at which *Marsilia vestita* grew abundantly and in fruit. Beyond this and sometimes lower down the sand was in the moist places near springs of surface water covered with mats of *Lysimachia Nummularia*, and a little higher up beyond the reach of water even in the rainy season began the terrestrial flora, conspicuous among which were several species of Oregon Grape (*Odostemon nervosum* and *Odostemon Aquifolium*) and some species of roses.

On studying the conditions of the habitat of the Persicaria it was soon evident how both phases were present at once, and why, strangest of all, the aquatic form was growing high and dry on the shore. No aquatic plants whatever were found in the water anywhere at this time.

It seems that the Willamette River annually rises during the rainy winter and spring seasons, the water often subsiding to the lowest mark until July or even later. During this period all

the low land along the stream is flooded. The roots of the *Persicaria* were then below water during the spring freshets and naturally developed the long stems of the floating aquatic stage. The associated *Marsilia vestita* too comes out then. The water rapidly lowers in July and August and after the low water mark has been reached in August the flowers of the *Persicaria* appear while the long stranded stems of the former floating aquatic phase are spread on the arid sand. The sterile terrestrial shoots after a while appear from the base of the aquatic stems, and not infrequently on them, but in this case only at the nodes where they happen to strike root. The probable reason why no aquatic *persicaria* stage was found in the water at low mark is that the shoots always sprout in spring, and when the water at that point is too deep for the branches to reach to the surface. The conditions near St. John's, Oregon are essentially the same regarding the plant, except that there is a large low stretch of meadow between the river and the plants which is submerged in spring.

It will be seen that the ecologic study of the amphibious *Persicarias* is absolutely necessary before we shall be able to say the final word concerning their taxonomical relations. It was probably due to lack of sufficiently observing these plants and studying them untiringly in their native habitat that we have not the knowledge of this difficult group which we ought to have at present when a new impetus has moved many to specialize in ecologic research.

OUR WINTER BIRDS.

BROTHER ALPHONSUS, C. S. C.

The winter of 1909-1910 was long but not very severe. Snow covered the ground for three months. Only for a short time, early in December and January, the temperature went below zero. The winter proved a poor one for birds—few species appeared, and of these, most were seen but rarely. The continual snow that covered up everything may have been one reason for the great scarcity of birds.

But the writer was unable to account for the total absence